CLAIMS:

1. A system for monitoring mechanical waves from a machine which in operation has moving particulate matter therein, the system including at least one sensor located on the machine at a location away from the central axis of the machine, the sensors being for sensing acoustic waves and including a transmitter for transmitting signals representing the sensed mechanical waves to a receiver at a location remote from the sensor(s), a data processor connected to the receiver for receiving signals from the receiver which signals represent the mechanical waves and processing the signals to produce output signals for display on a display means, wherein the output signals for display represent one or more parameters indicative of mechanical waves emitted from the machine over a predetermined period of time.

Sub B1

2. The system as claimed in claim 1 wherein the receiver is located on a stationery surface separate from the machine.

3. The system as claimed in claim 2 including a power supply located on the machine.

4. The system as claimed in claim 3 wherein the or each sensor is located on an exterior surface of the machine.

5. The system as claimed in claim 4 wherein the data processor is adapted to produce output signals which represent a plurality of acoustic events occurring within the machine, amplitudes of the acoustic events and data relating to the position of the acoustic events.

Sub A2

6. The system as claimed in claim 4 or claim 5, including a plurality of sensors spaced around the periphery of the machine to enable polar co-ordinates of the origin of emissions to be located.

Sub B1 cont.

7. The system as claimed in claim 6 wherein the sensors are equispaced around the periphery of the machine.

Sub A3

8. The system as claimed in claim 3 or 4 wherein sensors are arranged in an array around the machine

and along the length of the machine to enable to a three dimensional co-ordinate axis to be plotted of the location of the origin of omissions from the machine.

Sub A4

9. The system as claimed in claim 6 or claim 7 including at least one proximity detector for monitoring the location of the sensors at a predetermined time, whereby data from the proximity switch is adapted to be communicated to the data processor.

10. The system as claimed in claim 7 wherein the data processor includes a timing means for calculating the location of the or each sensor at a predetermined time.

11. The system as claimed in claim 9 wherein the or each sensor includes an accelerometer which is adapted to transmit data relating to the frequency of vibrational events occurring within the machine and the amplitude of the vibrational events at particular locations within the machine to the transmitter.

12. A method of analysing operational parameters of a machine having a moving particulate material therein, the method including the steps of recording data representing a number of mechanical events occurring within the machine over a predetermined period of time, the amplitude of the mechanical events occurring over the predetermined period of time and positional data relating to the position of the mechanical events occurring within the machine, displaying a graphical representation of the recorded data, the graphical representation including parameters relating to the number of mechanical events, the amplitude of mechanical events and the position of mechanical events occurring within the machine during the machines operation.

13. The method as claimed in claim 2 wherein the graphical representation of recorded data includes mean and standard deviation of vibrational events occurring within the machine, power spectral density of vibrational events occurring within the machine and histograms of amplitude of vibrational events occurring within the machine.

14. The method as claimed in claim 13 including the step of measuring volumetric load of the particulate matter within the machine by identifying the toe and shoulder portions of the particulate matter.

15. The method as claimed in claim 14 wherein volumetric load is determined from a polar co-ordinate plot of events occurring within the machine.

16. The method as claimed in claim 15 wherein volumetric load is calculated for a range of angles in which events within the machine have greatest deleterious effect on the interior of the machine.

17. The method as claimed in claim 16 wherein a value for volumetric filling of the mill is produced from the recorded data and the value of volumetric filling

$$f = \frac{(\theta - \sin\theta)}{2\pi}.$$

where θ is the angle (radiance) between the toe and shoulder positions of the particulate matter.

18. A method of controlling operational parameters of a machine having a moveable substance therein, the method including the steps of recording data representing a number of vibrational events occurring within a machine over a predetermined period of time, amplitude of the vibrational events occurring over the predetermined period of time and position data relating to the position of the vibrational events over the predetermined period of time, determining zones within the machine which are subject to predetermined levels of wear and altering the machine operational characteristics to reduce the levels of wear for the zones.

19. A method of identifying the volumetric load of particulate matter within a machine including the steps of receiving data, representing a number of mechanical events occurring within the machine over a predetermined period of time, the amplitude of the mechanical events occurring over the predetermined period of time and positional data relating to the position of the mechanical

events occurring within the machine, processing the received data to identify toe and shoulder positions of the particulate matter within the machine whereby the location of maximum deterioration of an inside surface of the machine can be minimised.

20. The method as claimed in claim 19 wherein data is received for a plurality of speeds of the machine.

21. The method as claimed in claim 20 including the step of identifying the fractional filling f of the machine where

$$f = \frac{(\theta - \sin\theta)}{2\pi}.$$

with θ being the angle (radiance) between the toe and shoulder positions of the charge.